CC/NUMBER 6
FEBRUARY 11, 1985

This Week's Citation Classic™

Sperry R W, Gazzaniga M S & Bogen J E. Interhemispheric relationships: the neocortical commissures; syndromes of hemisphere disconnection. (Vinken P J & Bruyn G W, eds.) *Handbook of clinical neurology*. Amsterdam: North-Holland, 1969. Vol. 4. p. 273-90.
[California Inst. Technology, Pasadena, and Ross-Loos Medical Group, Los Angeles, CA]

This paper reviews our first seven years of work at the California Institute of Technology on human patients with surgical disconnection of the cerebral hemispheres, along with a brief comment on a case of congenital absence of the corpus callosum. The basic split-brain symptoms are described with numerous figures. [The *Science Citation Index*® (*SCI*®) and the *Social Sciences Citation Index*® (*SSCI*®) indicate that this paper has been cited in over 290 publications since 1969.]

Roger W. Sperry
Division of Biology
California Institute of Technology
Pasadena, CA 91125

December 17, 1984

The impetus for this article was an invitation to contribute a handbook chapter on syndromes of the corpus callosum. The research itself had been prompted initially by puzzling reports in the early 1940s that complete surgical resection of the corpus callosum resulted (like its developmental absence) in no definite behavioral deficits in human patients even with extensive neurological and psychological testing. The collective evidence was fostering jocular appraisals suggesting that this largest fiber system of the brain must serve primarily as a mechanical strut (Karl Lashley) or that its main function appears to be that of transmitting epileptic seizures (Warren McCullough).

Genuine symptoms of hemisphere disconnection (the so-called "split-brain" phenomena) were first discovered and worked out in the 1950s in cats and monkeys. The work was started with Ronald Myers at the University of Chicago and later carried out at our new laboratory at Caltech. The split brain, however, has always seemed much more dramatic in human subjects operated on in the 1960s for intractable epilepsy. The human subjects gave direct verbal confirmation of the separate left and right domains of conscious experience—for example, when the vocal left hemisphere would tell us it had no awareness or recollection of a cognitive performance just carried out correctly by the other hemisphere.

The bulk of the work covered in this article had been joint research in which Gazzaniga (then at the University of California, Santa Barbara) had earlier participated as a graduate student and postdoctoral fellow at Caltech. By mutual agreement, he had done the patient transportation and test set-ups for the human studies in return for my doing the split-brain surgeries for his monkey experiments—a pooling of time and resources for mutual benefit. After each human testing session, we spent one to two hours together going over the results and discussing the type of tests to prepare for the next session.

Bogen had provided the first patient, suggested the project, talked Phillip Vogel, his chief, into undertaking the operations, and assisted in all the surgeries. He took care of the patients before the surgery and has taken care of them since. Bogen participated in some of the initial testing and had contributed clinical perspectives to my final draft of the manuscript.

Our original plan had been to rotate authorships among the three of us on all the publications about humans, but this got sidetracked by a number of things including my receiving invitations to present the work at symposia and conferences and in reviews like the cited article. As a trade-off for this extra advantage and others that naturally accrued to me in our professor-student relationship, it seemed fair to accede to Gazzaniga's request that in return his name might go first on the experimental papers since Bogen meanwhile had been diverted to separate projects.

The reason this article has come to be cited so frequently is probably because it is the earliest thorough review of the basic split-brain phenomena in human patients, it lists all three participants, and it includes a number of original test observations, insights, and interpretations I had not presented elsewhere. Related research stressing differential left-right cognitive specialization came later and is summarized in *The Neurosciences: Third Study Program*[1] and elsewhere.[2-5]

1. Sperry R W, Lateral specialization in the surgically separated hemispheres. (Schmitt F & Worden F, eds.) *The neurosciences: third study program*. Cambridge, MA: MIT Press, 1974. Vol. 3. p. 39-80.
2. Gazzaniga M S & Ledoux J E. *The integrated mind*. New York: Plenum Press, 1978. 168 p. (Cited 100 times.)
3. Bogen J E. Some educational implications of hemispheric specialization. (Wittrock M C, ed.) *The human brain*. Englewood Cliffs, NJ: Prentice-Hall, 1977. p. 133-52. (Cited 20 times.)
4. Levy J. Psychobiological implications of bilateral asymmetry. (Dimond S J & Beaumont J G, ed.) *Hemisphere function in the human brain*. London: Paul Elek, 1974. p. 121-83. (Cited 195 times.)
5. Bradshaw J L & Nettleton N C. *Human cerebral asymmetry*. Englewood Cliffs, NJ: Prentice-Hall, 1983. 335 p.